The Mediating Effects of Hardiness on Resilience in Repatriated Vietnam-Era Prisoners of War

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INTRODUCTION

Previous research from our Center has documented the importance of various psychological factors in predicting psychiatric resilience (Segovia et.al, 2012) and health (Segovia et. al, 2015) in repatriated Vietnam-era prisoners of war. Optimism was shown to be a better predictor of long-term psychiatric health than variables such as amount of antisocial/psychopathic traits, post-traumatic symptomatology upon repatriation, age, and length of solitary confinement. In the follow-up study (Segovia et. al, 2015), optimism measured at repatriation was again an excellent predictor of a composite measure of psychological (9 component measures) and physical (9 component measures) health. These findings emphasized the need to pursue a more direct assessment of resilience using both neurobiological (allostatic load) and psychological measures.

Psychological resilience refers to the ability to "bounce back" from adversity, adapt to various stressors, and bend but not break. Reivich and Shatte (2002) identified seven research-based abilities associated with resilience that are measureable, trainable and improvable. From this perspective, an individual's "Resilience Quotient" is comprised of optimism, emotional regulation, impulse control, empathy, causal analysis, self-efficacy, and reaching out (social support). More recently, Southwick and Charney (2012) developed a list of ten factors after conducting extensive interviews with individuals who had demonstrated what was felt to be effective coping following high levels of stress. These coping mechanisms, which the authors referred to as "resilience factors," included realistic optimism, facing fear directly, having a moral compass, drawing on faith (religion and spirituality), utilizing social support, fostering resilient role models, maintaining physical fitness, learning cognitive and emotional flexibility, and having a growth-promoting sense of meaning and purpose in life. Although the specific components of these two overlapping ways of defining the components of resilience differ slightly, there are also substantial areas of agreement. Individuals who have mastered these skills or otherwise demonstrate these dispositional traits, and are able to apply them in response to stressors or hassles, will predictably have an easier time "bouncing back" than individuals who have not. At a psychobiological level, systems associated with reward/motivation, fear responsiveness and adaptive social behavior, are each purportedly involved in resilient adaptation (Charney, 2004). These neural mechanisms may predict broader problems, such as cardiovascular stress-related resilience in the face of challenge and/or threat (Seery, 2011).

The personality construct of Hardiness, as originally defined by Kobasa (1979) and further developed by Maddi and Khoshaba (1994), may overlap and correlate with resilience, or otherwise mediate the relationship between the various predictors of resilience. Research has demonstrated the principle "hardy attitudes" of commitment, control, and challenge supplement skills associated with coping styles, social interactions and health-promoting practices. Individuals scoring high on the

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14. ABSTRACT

Previous research from REMC has documented the importance of various psychological factors in predicting psychiatric resilience (Segovia et.al, 2012) and health (Segovia et. al, 2013) in repatriated Vietnam-era prisoners of war. Optimism was shown to be a better predictor of long-term psychiatric health than variables such as amount of antisocial/psychopathic traits, post-traumatic symptomatology upon repatriation, age, and length of solitary confinement. In the follow-up study (Segovia et. al, 2013), optimism measured at repatriation was again an excellent predictor of a composite measure of psychological (9 component measures) and physical (9 component measures) health. These findings emphasized the need to pursue a more direct assessment of resilience using both neurobiological (allostatic load) and psychological measures. In the present study, we sought to disentangle the resilience-hardiness relationship through the use of mediation analysis.

15. SUBJECT TERMS

Prisoners of War, Resilience, Hardiness, Vietnam.

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Commitment factor have developed an enduring ability to "see the big picture" in order to maintain focus on interpersonal and intrapersonal goals. The Control factor reflects a trait-level ability to exert and preserve resources even in what may seem to be "uncontrollable" situation. Finally, those individuals scoring high on the Challenge factor, do not "catastrophize," but rather interpret stressors in such a way as to maintain hope, broaden their coping styles and learn from their experiences. Hardy individuals have been shown to be conscientious and extroverted, with fewer signs of overt psychopathology, and a greater ability to derive benefits from stressful life events. Hardiness has even been shown to directly moderate the long-term changes associated with captivity/torture in a sample of Israeli RPWs (Waysman et. al., 2001). In addition, dispositional hardiness and dispositional optimism, although moderately correlated, may differentially mediate the relationship between coping style and the effective coping with stressful situations (Maddi and Hightower, 1999). In the present study, we sought to disentangle the resilience-hardiness relationship through the use of mediation analysis. Specifically, we hypothesized that that dispositional hardiness would mediate the relationship between dispositional (ego-based) resilience and resilience associated more closely to stress adaptation.

METHOD

Subjects: One hundred twenty-eight Vietnam-era RPWs were evaluated at the REMC between March 2011 and April 2012 (Moore et.al, 2013). The average RPW age at the time of this evaluation was 71.9 years (+/- 5.6) and their age at capture was 29.1 years (+/- 4.8). These RPWs were held captive for an average of 51 months (+/- 32.4) and spent an average of 26.5 weeks (+/- 36.4) in solitary confinement. Using a torture scale that was administered as part of this re-evaluation (see Table 1), their average torture severity rating was 26.8 (+/- 11.7) using a 25-item (0 to 75) scale and their average percent weight loss during captivity was 25.1% (+/- 11.3). The vast majority of these RPWs were Caucasian (97.7%), married (93%) and officers (93%).

Two measures of psychological resilience and one measure of hardiness were completed by the RPWs as part of an extensive two-day medical and psychological examination that was both similar to their previous annual REMC evaluations and offered additional assessments as approved by a US Navy Institutional Review Board (Segovia et.al, 2015). Each RPW received funding for their travel and per diem costs, and each consented to participate in both the continued medical follow-up program and this unique project.

Instruments: The Bond Ego Resilience Scale (ER89; Block and Kremen, 1996) is a 14-item Likert-type scale, with each item rating from 1 "Does not apply at all" to 4 "Applies very strongly." Possible scores therefore range from 14 to 56. The published internal consistency of the Bond Ego Resilience Scale is 0.76 as measured by Chronbach's alpha; and the internal consistency within the current sample was 0.78. As originally developed, high scores on this scale were associated with Dispositional resilience. Such individuals exhibit relatively enduring positive affect, openness to experience, motivational control, and resourceful adaptation as core features of their personality.

The Connor-Davidson Resilience Scale (CD-RISC10; Campbell-Sills and Stein, 2007) is a 10-item Likert-type scale, with each item rating from 0 "Not at all true" to 4 "True nearly all the time." Possible scores therefore range from 0 to 40. The published internal consistency of the CR-RISC10 is 0.85 as measured by Chronbach's alpha, and the internal consistency within the current sample was 0.86. As originally developed (Connor and Davidson, 2003), this scale was designed to identify those individuals

who were most likely to “bounce back” from physical or emotional difficulties as a result of successful stress-coping abilities following traumatic events. During test development, items were selected in such a way as to reflect hardiness, action orientation, self-confidence, adaptability to change, humor, and secure/stable emotional bonds. Scores on this instrument have demonstrated specific sensitivity to depression (Vahia et. al, 2010),PTSD (New et. al, 2009), positive/negative affect before military deployment (Maguen et. al, 2008) and response to treatment of trauma-related stress (Davidson et. al, 2004). The CD-RISC10 may be more state-like and the ER89 may be more trait-like in their measurement of resilience.

The Personal Views Survey, revised third edition (PVS-IIIR; Maddi et al., 2006) is an 18-item Likert-type scale, with each item rating from 0 “Not at all true” to 3 “Very true”, with some items being reverse scored. Possible scores therefore range from 0 to 54. In addition to the Total Score, separate scores are available for six-item subscales associated with Commitment (seeing the big picture), Control (internal tenacity when dealing with life’s stressors) and Challenge (stresses not viewed as catastrophes). The published internal consistency of the Personal Views Survey is 0.80 as measured by Chronbach’s alpha; and, the internal consistency within the current sample was 0.67. As originally developed, personality trait Hardiness was defined as a stable disposition, felt to be separate from negative affectivity and neuroticism in predicting adaptability. These hardy attitudes are part of a larger Hardiness Model (Maddi, 2004) that also includes hardy coping skill, hardy social support and hardy health practices.

Analysis: A review of the graphical information prior to mediation analysis suggested that there might be one multivariate outlier based on a comparison of predicted scores with residual errors. Although this subject’s standardized residual was greater than 3.0, Mahalanobis distance and leverage statistics were within normal limits and the subject was retained.

A liner relationship was graphically demonstrated between each of the two predictors (ER89 and PVSIII-R) and the outcome variable (CD-RISC10) and neither quadratic nor cubic scores were significant when used to predict the outcome variable. The residuals themselves were normally distributed and there was no graphical evidence of heteroscedasticity.

Assuming the need to detect a medium effect ($f^2 = 0.15$), with alpha = 0.05 and power = 0.80, the minimum number of subjects needed for this mediation analysis ranged from 67 (Cohen, 1992) to 118 using bias-corrected bootstrap sampling to generate confidence intervals (Fritz and MacKinnon, 2007). For all mediation analyses, ER89 was the independent variable, CD-RISC10 was the dependent variable and PVS-IIIR was the mediator, reflecting our interpretation of the dispositional nature of the ER89 and the PVSIII-R.

Analyses were performed using SPSS version 19. Pearson product-moment correlations were conducted to determine the relationships among the variables**.** Mediation analyses were conducted using the methods described by Jose (2013) and Hayes (2013), to include use of PROCESS syntax for SPSS (Hayes, 2012). Confidence intervals created within PROCESS were based on 10,000 bootstrap sample and three effect size metrics (completely standardized effect, ratio of indirect effect to total effect, and Kappa-Squared (K^2, which ranges from 0 to 1.0 and is interpreted qualitatively in a manner analogous to R^2).

RESULTS

PVS-IIR Hardiness total scores ranged from 23 to 53, while the range of scores for both Commitment and Control was from was from 7 to 18 (Table 2). The Hardiness Challenge scale exhibited a larger range (1 to 18) and the largest standard deviation of the three subscales (2.82). The ER89 scores ranged from 33 to 56 (standard deviation = 4.94), while the CD-RISC10 ranged from 20 to 40 (Standard deviation = 4.57). There were no missing data and review of the histograms for each of the three tests confirmed that the distributions did not violate the assumption of normality.

As shown in Table 3, all correlations between the scales and subscales were highly significant, with the highest correlations between the PVS-IIIR subscales and the total Hardiness score (.763 to .858). The next highest correlation (0.705) was between the ER89 and the CD-RISC10. In this sample, the PVS-IIIR Hardiness score predicted approximately 38 percent of the ER89 score and approximately 40 percent of the CD-RISC10 score.

From a simple mediation analysis conducted using ordinary least squares path analysis, ego resilience indirectly influenced traumatic stress resilience through its effect on hardiness. As can be seen in Figure 1 and Table 4, repatriates with higher ego resilience were hardier than those repatriates with lower ego resilience (Hayes a = .735; .569 to .901), and hardy repatriates were more stress resilient (Hayes b = .246; 130 to .362) than the less hardy. A bias-corrected confidence interval for the indirect effect (Hayes ab = .1807; se = .0479; Sobel Z = 3.77, p = .0002) based on 10,000 bootstrap samples was entirely above zero (.094 to .292). There was also evidence that ego resilience influenced stress resilience independent of its effect on hardiness (c' = .472, p < .0001). This analysis was repeated without the previously mentioned outlier and no significant differences were observed.

Three additional simple mediation analyses were conducted using the identical methodology, with each of the hardiness components being substituted for total hardiness. In the first of these, ego resilience indirectly influenced traumatic stress resilience through its effect on the Commitment component of hardiness. Repatriates with higher ego resilience demonstrated more Commitment than those repatriates with lower resilience (Hayes a = .249; .179 to .318), and the more committed were more stress resilient (b = .566; .290 to .842) than repatriates with low Commitment. Table 4 also shows that a bias-corrected confidence interval for the indirect effect (ab = .1406; Sobel Z = 3.49; se = .0403) based on 10,000 bootstrap samples was entirely above zero (.063 to .242). Other effect size estimates for Commitment are also shown in Table 4. There was also evidence that ego resilience influenced stress resilience independent of its effect on hardiness (Hayes c' = .513, p < .0001).

Next, ego resilience indirectly influenced traumatic stress resilience through its effect on the Control component of hardiness. Repatriates with higher ego resilience were also more controlled than those repatriates with lower resilience (Hayes a = .156; .088 to .224), and controlled repatriates were more stress resilient (Hayes b = .613; .329 to 897) than repatriates with low Control. A bias-corrected confidence interval for the indirect effect (Hayes ab = .0956; Sobel Z = 3.08; se = .031) based on 10,000 bootstrap samples (Table 4) was entirely above zero (.045 .169). Other effect size estimates for Control are also shown in Table 4. There was also evidence that ego resilience influenced stress resilience independent of its effect on hardiness (Hayes c' = .558, p < .0001).

Finally, ego resilience indirectly influenced traumatic stress resilience through its effect on the Challenge component of hardiness. For this path, repatriates with higher ego resilience were not more likely to be controlled than those repatriates with lower resilience (Hayes a = .330; .248 to .413), and

controlled repatriates were not more stress resilient (Hayes b = .181; 067 to .429). A bias-corrected confidence interval for the indirect effect (Hayes ab = .060; Sobel Z = 1.41; se = .042) based on 10,000 bootstrap samples was entirely above zero -.044 to .155). Other effect size estimates are also shown in Table 4. Other effect size estimates for Challenge are also shown in Table 4. There was, however, evidence that ego resilience influenced stress resilience independent of its effect on hardiness (Hayes c' = .593, $p < .0001$).

A more complex serial multiple mediation analysis (Table 5) using ordinary least squares path analysis also revealed that ego resilience influenced traumatic stress resilience through its' effect on the Commitment (Hayes ab = .106; .021 to .203) and Control (Hayes ab = .031; .001 to .097) components of hardiness, as well as through the Commitment-Control tandem path (Hayes ab = .044: .014 to .096). The indirect effect through the Challenge component of hardiness was nonsignificant (Hayes ab = -.016; -.094 to .047). What's more, any of the indirect paths through Challenge, to include the most complete path, were nonsignificant. Figure 2a depicts this complex serial mediation of the three components of hardiness. This model entails seven indirect paths and twenty-one pairwise contrasts between these paths. Seven of these contrasts resulted in confidence intervals that did not include zero – all of which reemphasized the inferiority of any path that included Challenge as a mediator.

A slightly less complex serial multiple mediation analysis (Figure 2b) revealed similar results with, as did a model in which the mediation effects of the Commitment and Control components of hardiness were evaluated in parallel (Figure 2c). In the two variable serial mediation model, ego resilience again influenced traumatic stress resilience through its effect on the Commitment (Hayes ab = .099; .017 to .198) and Control (Hayes ab = .042; .015 to .090) components of hardiness, as well as through the Commitment-Control tandem path (Hayes ab = .030; .001 to .092). This three path model resulted in three pair-wise contrasts, all of which were nonsignificant (95% bias-corrected contrast intervals that included zero).

The final multiple mediation model (Figure 2c) was also conducted using ordinary least squares path analysis, but with Commitment and Control evaluated in parallel and independent of each other. Ego resilience indirectly influenced traumatic stress resilience (Table 6) through its effect on both Commitment (Hayes ab = .099; .017 to .197; Sobel Z = 2.52, $p = .012$) and Control (Hayes ab = .071; .023 to .143; Sobel Z = 2.48, $p = .013$). This parallel model was specifically conducted to evaluate the relative impact of these two mediators, and the difference between their effects (.028) was nonsignificant (the 95% bias-corrected contrast interval included zero).

DISCUSSION

To our knowledge, this mediation effect of hardiness has not previously been evaluated and has not been studied in former prisoners of war. Hardiness partially mediates the relationship between dispositional resilience and process-based resilience. There remains, however, a significant relationship between a trait resilience and state following this mediation and only two of the measured components of hardiness (commitment and control) contributed to this mediation. The indirect effect was considered "Large" as measured by K^2 and accounted for approximately 28% of the total variance (Table 4). At the factor level, Commitment had the largest K^2 and percent of total variance accounted for, while Challenge was the smallest and not reliably different from zero.

Several studies have also found the Challenge factor to be less predictive than the other factors. Total Hardiness score have been shown to moderate the relationship between stressful life events and social support, but at the factor level Challenge was uniquely uncorrelated with either stressful life events or quality of social support (Pengilly and Dowd, 2000). More recently, when all three factors were entered as mediators of the psychopathy-anxiety relationship, only the indirect effect of commitment was found significant (Sandvik et. al, 2015). A final demonstration of the possible unique attributes of the Challenge factor relate to the Hardiness Profile. As originally developed, this approach to the understanding of hardiness used cluster analysis to identify four profile types, and found that individuals with "rigid controls" (high Commitment, high Control and low Challenge) had the greatest risk of having health problems (Johnsen et. al, 2014). In fact, this group with "unbalanced hardiness" was most likely to have neuroimmunological responses to stress (Sandvik et. al, 2013). Future research is needed to identify who these unique characteristics relate to other physical and psychological variables among Vietnam-era repatriates.

The mediation effect of hardiness on resilience has a potentially important military application since research has demonstrated both the ability of training to enhance hardiness (Maddi et. al, 2009) and the positive influence that hardy military leaders can have on their troops (Bartone, 2006). Additional research is needed to more fully define a model of psychological health that is as relevant to both operational forces and repatriates. One such model of "Psychological Capital" includes the constructs of efficacy, hope and optimism in addition to resilience (Luthans et. al, 2007) and supports our earlier findings regarding the long-term effects of optimism. Such a comprehensive model is also more aligned with attempts within the military to evaluate and enhance soldier fitness (Casey, 2011).

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Table 1
Demographics

Variable	n	Median	Mean	Std Dev
Current Age	128	71	71.9	5.6
Age at Capture	128	28.2	29.1	4.8
Captivity (months)	128	65.5	51	32.4
Solitary (weeks)	128	10.5	26.5	36.4
Current Torture Scale	128	28	26.8	11.7
Percent Weight Loss (est)	128	25	25.1	11.3
Current Education (years)	128	17	18	1.6

Table 2
Scale
Descriptives

Variable	N	Minimum	Maximum	Mean	Std Dev
PVS-IIIR Hardiness Total	128	23	53	39.52	5.90
Hardiness Commitment (Cm)	128	7	18	14.14	2.31
Hardiness Challenge (Ch)	128	1	18	11.61	2.82
Hardiness Control (Cn)	128	7	18	13.77	2.04
ER89	128	33	56	46.09	4.94
CD-RISC10	128	20	40	33.88	4.57

Table 3
Scale
Correlations

	Cm	Ch	Cn	PVS-IIIR	ER89	CD-RISC10
Cm	1	-----	-----	-----	-----	-----
Ch	0.560 0.000	1	-----	-----	-----	-----
Cn	0.498 0.000	0.463 0.000	1	-----	-----	-----
PVS-IIIR	0.832 0.000	0.858 0.000	0.763 0.000	1	-----	-----
ER89	0.531 0.000	0.579 0.000	0.377 0.000	0.615 0.000	1	-----
CD-RISC10	0.579 0.000	0.482 0.000	0.501 0.000	0.631 0.000	0.705 0.000	1

Table 4
Mediation Analyses - Single Mediator

SIGNIFICANCE

	Jose (2013)				Hayes (2013) Sobel	
Mediator	**a*b**	**SE_{ab}**	**Sobel Z**	**p**	**Z**	**p**
Hardiness	0.18081	0.04737	3.81663	0.000135	3.7741	0.0002
Control (Cn)	0.09563	0.03053	3.13234	0.001734	3.0835	0.0020
Challenge (Ch)	0.05973	0.04191	1.42512	0.154122	1.4104	0.1584
Commitment (Cm)	0.14037	0.03976	3.53050	0.000415	3.4902	0.0005

EFFECT SIZE

	Hayes (2013)			Preacher & Kelley
Mediator	**Indirect**	**Completely Standardized**	**Ratio of Ind. to Total**	**K^2**
Hardiness	0.1807	0.1950	0.2767	0.2178
95% CI*	.09, .29	.11 .29	.15, .43	.12, .32
Control (Cn)	0.0956	0.1032	0.1464	0.1393
95% CI*	.05, .17	.05, .18	.07, .25	.07, .22
Challenge (Ch)	0.0597	0.0645	0.0915	0.0771
95% CI*	-.04, .16	-.05, .16	-.07, .23	.00, .19
Commitment (Cm)	0.1406	0.1517	0.2153	0.1837
95% CI*	.06, .24	.07, .24	.10, .36	.09, .28

* Confidence intervals are based on 10,000 bias-corrected boostrap samples

Table 5

Mediation Analyses - Three Serial Mediators

Model: CDRISC = 0.4773Cn - 0.0788Ch + 0.4247Cm + 0.4992ER89 - 0.7883

Total Effect = 0.6531; Direct Effect = 0.4992; Indirect Effect = 0.1539

Hayes (2013) Indirect Effect	Effect Size	Completely Standardized	Ratio of Ind. to Total
Indirect 1	0.1055	0.1139	0.1616
95% CI*	.021, .203	.023, .209	.034, .305
Indirect 2	0.0435	0.0469	0.0666
95% CI*	.014, .096	.014, .104	.019, .153
Indirect 3	-0.0065	-0.0070	-0.0100
95% CI*	-.045, .016	-.053, .017	-.080, .023
Indirect 4	-0.0019	-0.0020	-0.0029
95% CI*	-.013, .005	-.138, .006	-.020, .008
Indirect 5	0.0309	0.0334	0.0474
95% CI*	.000, .097	.000, .105	.000, .152
Indirect 6	-0.0013	-0.0015	-0.0021
95% CI*	-.015, .003	-.016, .003	-.022, .004
Indirect 7	-0.0163	-0.0176	-0.0249
95% CI*	-.094, .047	-.106, .048	-.157, .068

* Confidence intervals are based on 10,000 bias-corrected boostrap samples

Indirect Path Key		
Ind1	**ER89 --- Cm --- CDRISC10**	
Ind2	**ER89 --- Cm --- Cn --- CDRISC10**	
Ind3	ER89 --- Cm --- Ch --- CDRISC10	
Ind4	ER89 --- Cm --- Cn --- Ch --- CDRISC10	(complete)
Ind5	**ER89 --- Cn --- CDRISC10**	
Ind6	ER89 --- Cn --- Ch --- CDRISC10	
Ind7	ER89- -- Ch --- CDRISC10	

Table 6

Mediation Analyses - Two Mediators

SERIAL MEDIATION — **Hayes (2013)**

Model: CDRISC = 0.4565Cn + 0.3984Cm + 0.4829ER89 + -0.2961

Total Effect = 0.6531; Direct Effect = 0.4829; Indirect Effect = 0.1702

Indirect Effect	Effect Size	Completely Standardized	Ratio of Ind. to Total
Indirect 1	0.0990	0.1068	0.1516
95% CI*	.017, .198	.019, .202	.027, .291
Indirect 2	0.0416	0.0449	0.0637
95% CI*	.015, .090	.016, .099	.022, .147
Indirect 3	0.0296	0.0319	0.0453
95% CI*	.000, .092	-.000, .097	.000, .140

Indirect Path Key

Ind1	ER89 --- Cm --- CDRISC10	
Ind2	ER89 --- Cm --- Cn --- CDRISC10	(complete)
Ind3	ER89 --- Cn --- CDRISC10	

PARALLEL MEDIATION — **Hayes (2013)**

SIGNIFICANCE

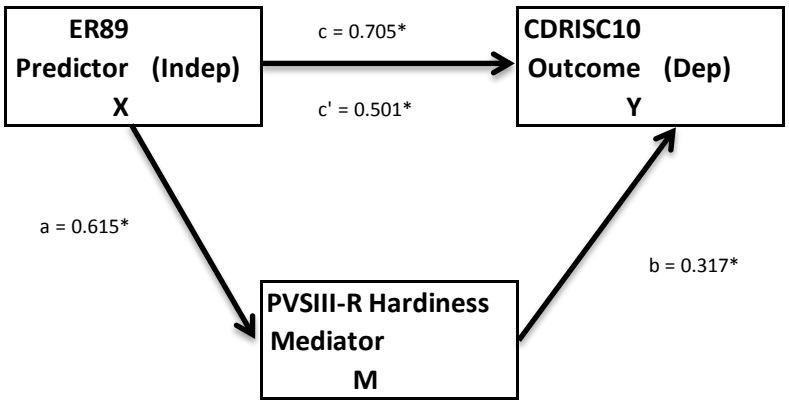
Mediator	Sobel Z	p
Commitment (Cm)	2.5228	0.0116
Control (Cn)	2.4791	0.0132

EFECT SIZE

Mediator	Effect	Completely Standardized	Ratio of Ind. to Total
Commitment (Cm)	0.0990	0.1068	0.1516
95% CI*	.017, .197	.017, .201	.025, .290
Control (Cn)	0.0712	0.0768	0.109
95% CI*	.023, .143	.026, .151	.035, .220
Cm minus Cn Contrast	0.0278	N/A	N/A
95% CI*	-.089, .144		

* Confidence intervals are based on 10,000 bias-corrected boostrap samples

Figure 1
Basic Mediation Model



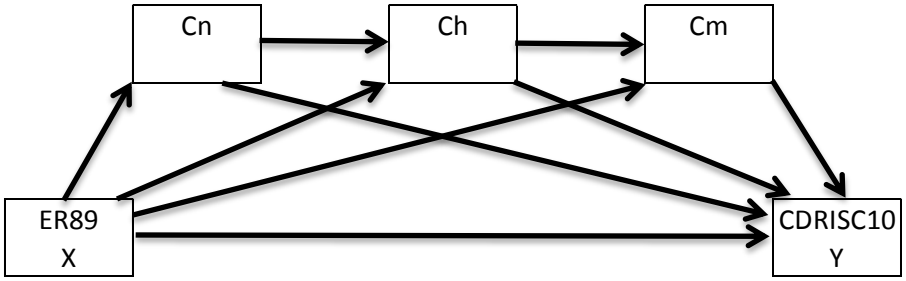
Sobel z-value = 3.8166 (p = 00001) ab = 0.18081, se = 0.04737

Standardized Coefficients		R^2 Measures (Variance)
total	0.705	0.497
direct	0.510	0.161
indirect	0.195	0.335
ind/total	0.276	0.675

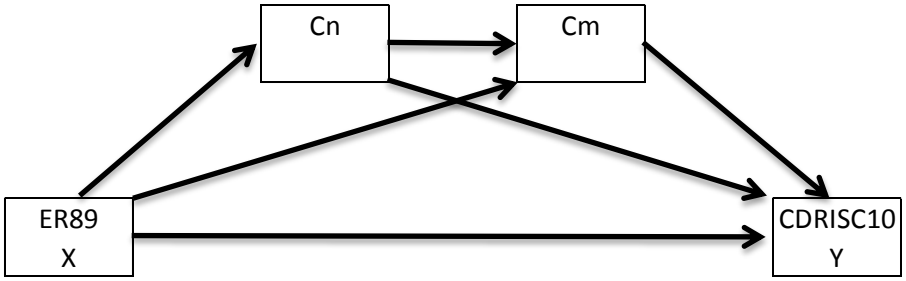
Jose, P.E., (2013). Doing Statistical Mediation. Guilford, New York

Figure 2
Multiple Mediators

Model a - Three Serial Mediators



Model b - Two Serial Mediators



Model c - Two Parallel Mediators